^{160}Gd(^{9}Be,5nγ):E=59 MeV 1978Ki02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen[#]	NDS 147, 1 (2018)	30-Nov-2017

1978Ki02: ^{160}Gd(^{9}Be,5nγ),E=59 MeV. Measured Eγ, Iγ, γγ, γ(lin pol), γ(θ) at eight angles ranging from 65° to 160° relative to the beam direction.

^{164}Er Levels

E(level)[†]	J^{π}[‡]
0.0[@]	0^+
91.37[@] 6	2^+
299.5[@] 3	4^+
614.3[@] 4	6^+
1024.4[@] 4	8^+
1197.3[&] 5	5^+
1358.2[&] 5	6^+
1517.8[@] 5	10^+
1544.7[&] 4	7^+
1663.7[a] 4	5^-
1744.2[a] 5	6^-
1744.7[&] 5	8^+
1845.1[a] 5	7^-
1963.9[a] 5	8^-
1976.7[&] 5	9^+
1984.6[b] 5	7^-
2082.4[@] 5	12^+
2091.2[c] 5	(8)
2107.9[a] 5	9^-
2163.1[b] 6	8^-
2184.0[&] 5	10^+
2260.7[a] 5	10^-
2363.0[b] 6	9^-
2407.9[a] 6	11^-
2421.3[c] 5	(10)
2479.0[&] 6	11^+
2518.9[d] 5	12^+
2583.0[b] 6	10^-
2630.8[a] 6	12^-
2702.2[@] 6	14^+
2733.1[&] 6	12^+
2800.8[c] 6	(12)
2814.6[a] 6	13^-[#]
2821.8[b] 7	11^-
2874.3[d] 6	14^+
3026.6[&] 6	13^+
3066.4[a] 7	14^-
3078.2[b] 7	12^-
3244.5[c] 7	(14)

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$^{160}Gd(^{9}Be,5n\gamma)$:E=59 MeV 1978Ki02 (continued)

^{164}Er Levels (continued)

E(level)[†]	J^{π}[‡]	Comments
3262.6[d] 6	16^+	
3266.8[&] 7	14^+	
3280.5[a] 7	15^-	
3351.4[b] 7	13^-	
3411.2[@] 7	16^+	
3518.3[&] 7	(15^+)	
3559.5[a] 7	16^-	
3760.1[c] 7	(16)	
3768.1[d] 7	18^+	
3800.5[&] 7	(16^+)	J^{π}: from Adopted Levels.
3804.9[a] 7	17^-	
4017.8[&] 8	(17^+)	
4105.0[a] 8	18^-	
4121.5[@] 7	18^+	
4344.2[c] 8	(18)	
4345.3[d] 7	20^+	
4384.9[a] 8	19^-	
4589?[&] 1	(19^+)	
4701.4[a] 9	20^-	
4868.2[@] 8	(20^+)	
4987.1[c] 9	(20)	
4999.3[d] 8	22^+	
5017.9[a] 8	21^-	
5349.5[a] 9	(22^-)	
5678?[c] 1	(22)	
5703[a] 1	(23^-)	
5728.1[d] 9	(24^+)	
6053? 1	(24^-)	

† From least-squares fit to Eγ data, assuming Δ(Eγ)=0.3 keV.

‡ From 1978Ki02 based on previous assignments for low-lying levels, $\gamma(\theta)$ and linear polarization data, and band structures in the present experiment.

π=−, spin is odd from angular distribution coefficient and linear polarization (1978Ki02).

@ Band(A): $K^{\pi}=0^+$ ground-state band.

& Band(B): $K^{\pi}=2^+$ γ-vibrational band.

a Band(C): $K^{\pi}=5^-$ band.

b Band(D): $K^{\pi}=7^-$ band.

c Band(E): Band based on (8).

d Band(F): $K^{\pi}=12^+$ band,α=0.

^{160}Gd(^{9}Be,5nγ):E=59 MeV 1978Ki02 (continued)

γ(^{164}Er)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	α[a]	Comments
91.37 *6*		91.37	2+	0.0	0+	E2	4.14	Mult.: from Adopted Gammas.
118.8	1.4	1963.9	8−	1845.1	7−	(M1+E2)		A_2=−0.60 *3*; A_4=+0.08 *5*
139.5[†]		1984.6	7−	1845.1	7−			
152.8	4.2	2260.7	10−	2107.9	9−	(M1+E2)		A_2=−0.058 *11*; A_4=0.000 *18*
178.5	5.2	2163.1	8−	1984.6	7−			A_2=+0.186 *11*; A_4=+0.017 *17*
199.9	3.3	2363.0	9−	2163.1	8−			A_2=+0.153 *24*; A_4=+0.01 *4*
208.1[@]	100	299.5	4+	91.37	2+	E2	0.221	A_2=+0.248 *3*; A_4=−0.046 *4*
219.7[†]	1.6	1963.9	8−	1744.2	6−	(E2)		A_2=+0.207 *17*; A_4=−0.03 *3* A_2, A_4 for 219.7+220.0.
220.0[†]	2.5	2583.0	10−	2363.0	9−			A_2=+0.207 *17*; A_4=−0.03 *3* A_2, A_4 for 220.0+219.7.
238.8	2.2	2821.8	11−	2583.0	10−			A_2=+0.149 *21*; A_4=−0.05 *3*
240.5	7.4	1984.6	7−	1744.2	6−			A_2=+0.105 *7*; A_4=−0.031 *11*
256.4	1.8	3078.2	12−	2821.8	11−			A_2=+0.18 *3*; A_4=+0.03 *5*
273.2	0.5[‡]	3351.4	13−	3078.2	12−			
296.9	8.9	2260.7	10−	1963.9	8−	(E2)		A_2=+0.237 *9*; A_4=−0.064 *14*
314.9[@]	106	614.3	6+	299.5	4+	E2	0.0596	A_2=+0.251 *3*; A_4=−0.056 *5*
330.1	2.0	2421.3	(10)	2091.2	(8)			A_2=+0.26 *3*; A_4=−0.04 *4*
334.9[†]	1.0	2518.9	12+	2184.0	10+			
347.5[†]	2.4	1544.7	7+	1197.3	5+			
355.4[†]	1.7	2874.3	14+	2518.9	12+			
370.06	6.9	2630.8	12−	2260.7	10−	(E2)		A_2=+0.332 *9*; A_4=−0.078 *15*
379.5	3.0	2800.8	(12)	2421.3	(10)	(E2)		A_2=+0.274 *23*; A_4=−0.07 *4*
386.5	3.7	1744.7	8+	1358.2	6+	(E2)		A_2=+0.213 *19*; A_4=−0.04 *3*
388.2	3.9	3262.6	16+	2874.3	14+	(E2)		A_2=+0.312 *18*; A_4=−0.07 *3*
406.8	3.6	2814.6	13−	2407.9	11−	Q		A_2=+0.286 *18*; A_4=−0.10 *3*
410.2[@]	74	1024.4	8+	614.3	6+	E2	0.0279	A_2=+0.304 *3*; A_4=−0.074 *4*
419.9[c]	0.9[‡]	2583.0	10−	2163.1	8−			
432.0	6.0	1976.7	9+	1544.7	7+	Q		A_2=+0.320 *14*; A_4=−0.081 *23*
435.6	7.9	3066.4	14−	2630.8	12−	Q		A_2=+0.305 *14*; A_4=−0.108 *22*
436.5	2.7	2518.9	12+	2082.4	12+			A_2=+0.31 *3*; A_4=0.00 *4*
439.3	4.4	2184.0	10+	1744.7	8+	Q		A_2=+0.258 *21*; A_4=−0.04 *3*
443.7	2.1	3244.5	(14)	2800.8	(12)	(Q)		A_2=+0.43 *7*; A_4=−0.12 *10*
444.6	1.1	2421.3	(10)	1976.7	9+	D		A_2=−0.21 *6*; A_4=+0.05 *10*
458.8	1.3[‡]	2821.8	11−	2363.0	9−			
465.9	3.8	3280.5	15−	2814.6	13−	Q		A_2=+0.271 *20*; A_4=−0.08 *3*
491.7[†]	2.8	3518.3	(15+)	3026.6	13+			
493.1[†]	5.9	3559.5	16−	3066.4	14−			
493.4[@]	60	1517.8	10+	1024.4	8+	E2		A_2=+0.316 *4*; A_4=−0.084 *6*
499.5	2.3	4017.8	(17+)	3518.3	(15+)	(Q)		A_2=+0.27 *4*; A_4=−0.06 *6*
502.3	5.4	2479.0	11+	1976.7	9+	Q		A_2=+0.292 *15*; A_4=−0.033 *24*
505.5	8.3	3768.1	18+	3262.6	16+	Q		A_2=+0.297 *10*; A_4=−0.095 *11*
515.6	2.5	3760.1	(16)	3244.5	(14)	Q		A_2=+0.23 *3*; A_4=−0.11 *5*
524.4	5.1	3804.9	17−	3280.5	15−	Q		A_2=+0.28 *3*; A_4=−0.07 *5*
529.6	0.6[‡]	3351.4	13−	2821.8	11−			
533.7[b]	4.0[b]	3266.8	14+	2733.1	12+	(Q)		A_2=+0.32 *3*; A_4=−0.08 *4* A_2, A_4 for doublet.
533.7[b]	4.0[b]	3800.5	(16+)	3266.8	14+			E_γ: self-coincident doublet. Placement is from Adopted Gammas.
545.5	3.3	4105.0	18−	3559.5	16−	(Q)		A_2=+0.35 *4*; A_4=−0.08 *7*
546.5[†]	1.9	2091.2	(8)	1544.7	7+			

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^{160}Gd(^{9}Be,5nγ):E=59 MeV 1978Ki02 (continued)

γ(^{164}Er) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ	Comments
546.9[†]	7.0	1744.2	6$^-$	1197.3	5$^+$			
547.6	4.3	3026.6	13$^+$	2479.0	11$^+$	(Q)		A_2=+0.32 *4*; A_4=−0.04 *7*
549.1	2.0	2733.1	12$^+$	2184.0	10$^+$	(Q)		A_2=+0.25 *6*; A_4=−0.02 *9*
560.4[@]	9.7	3262.6	16$^+$	2702.2	14$^+$	E2		A_2=+0.328 *11*; A_4=−0.106 *18* POL=+0.58 *5*.
564.6[@]	42	2082.4	12$^+$	1517.8	10$^+$	E2		A_2=+0.304 *4*; A_4=−0.082 *6*
571[#c]	2.5	4589?	(19$^+$)	4017.8	(17$^+$)			
577.2	5.4	4345.3	20$^+$	3768.1	18$^+$	Q		A_2=+0.322 *18*; A_4=−0.10 *3*
578.2	3.7	3280.5	15$^-$	2702.2	14$^+$	D		A_2=−0.04 *5*; A_4=−0.01 *8*
580.0	2.9	4384.9	19$^-$	3804.9	17$^-$			A_2=+0.21 *6*; A_4=−0.05 *9*
583.0[†]	1.6	1197.3	5$^+$	614.3	6$^+$			
584.1[†]	1.8	4344.2	(18)	3760.1	(16)			
596.4	1.6	4701.4	20$^-$	4105.0	18$^-$	Q		A_2=+0.22 *4*; A_4=−0.13 *7*
619.7[@]	21	2702.2	14$^+$	2082.4	12$^+$	E2		A_2=+0.327 *7*; A_4=−0.091 *11*
633.0	1.4	5017.9	21$^-$	4384.9	19$^-$	(Q)		A_2=+0.22 *7*; A_4=−0.09 *12*
642.9[†]	1.4	4987.1	(20)	4344.2	(18)			
648.1[†]	1.1	5349.5	(22$^-$)	4701.4	20$^-$			
654.0	2.4	4999.3	22$^+$	4345.3	20$^+$	Q		A_2=+0.29 *3*; A_4=−0.14 *5*
666.2[†]	1.3	2184.0	10$^+$	1517.8	10$^+$			
685[#]	0.7	5703	(23$^-$)	5017.9	21$^-$			
691[#c]	0.6	5678?	(22)	4987.1	(20)			
703[#c]	0.8	6053?	(24$^-$)	5349.5	(22$^-$)			
709.0[@]	3.9	3411.2	16$^+$	2702.2	14$^+$	(E2)		A_2=+0.285 *16*; A_4=−0.03 *3* A_2, A_4 for 709.0+710.3.
710.3[@]	2.3	4121.5	18$^+$	3411.2	16$^+$	(E2)		A_2=+0.285 *16*; A_4=−0.03 *3* A_2, A_4 for 709.0+710.3.
720.3	2.5	1744.7	8$^+$	1024.4	8$^+$	M1+E2		A_2=+0.22 *6*; A_4=−0.24 *5* POL=−0.82 *12*. Mult.,δ: ΔJ=0, M1+E2 from $\gamma(\theta)$, and POL.
728.8[#]	1.2	5728.1	(24$^+$)	4999.3	22$^+$			
732.2	4.2	2814.6	13$^-$	2082.4	12$^+$	E1(+M2)	−0.040 *26*	A_2=−0.25 *3*; A_4=−0.03 *5* POL=+0.44 *10*. Mult.,δ: from $\gamma(\theta)$ and POL.
743.9	3.6	1358.2	6$^+$	614.3	6$^+$			A_2=−0.12 *3*; A_4=−0.12 *5*
746.7[#]	1.8	4868.2	(20$^+$)	4121.5	18$^+$			
791.9[@]	4.2	2874.3	14$^+$	2082.4	12$^+$	E2		A_2=+0.32 *3*; A_4=−0.13 *4*
820.9[†]	2.2	1845.1	7$^-$	1024.4	8$^+$			
890.2	3.9	2407.9	11$^-$	1517.8	10$^+$	D		A_2=−0.234 *21*; A_4=+0.03 *4*
897.9	7.3	1197.3	5$^+$	299.5	4$^+$	D+Q		A_2=−0.094 *20*; A_4=+0.07 *3*
930.4	5.3	1544.7	7$^+$	614.3	6$^+$	D+Q		A_2=−0.269 *18*; A_4=+0.18 *3*
952.2	2.8	1976.7	9$^+$	1024.4	8$^+$	D+Q		A_2=−0.31 *3*; A_4=+0.13 *5*
1001.1	1.8	2518.9	12$^+$	1517.8	10$^+$	(Q)		A_2=+0.24 *6*; A_4=−0.09 *9*
1049.6	1.9	1663.7	5$^-$	614.3	6$^+$	D		A_2=0.00 *5*; A_4=−0.05 *8*
1083.45	2.3	2107.9	9$^-$	1024.4	8$^+$	D		A_2=−0.20 *6*; A_4=+0.05 *10*
1230.6	5.2	1845.1	7$^-$	614.3	6$^+$	D		A_2=−0.100 *20*; A_4=0.01 *3*
1364.1	3.2	1663.7	5$^-$	299.5	4$^+$			A_2=−0.06 *5*; A_4=−0.11 *8*

[†] Unresolved γ line.
[‡] Weak line.

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$^{160}Gd(^{9}Be,5n\gamma)$:E=59 MeV 1978Ki02 (continued)

$\gamma(^{164}Er)$ (continued)

[#] Doppler-broadened peak.

[@] Linear polarization measurement is consistent with ΔJ=2, E2 transition.

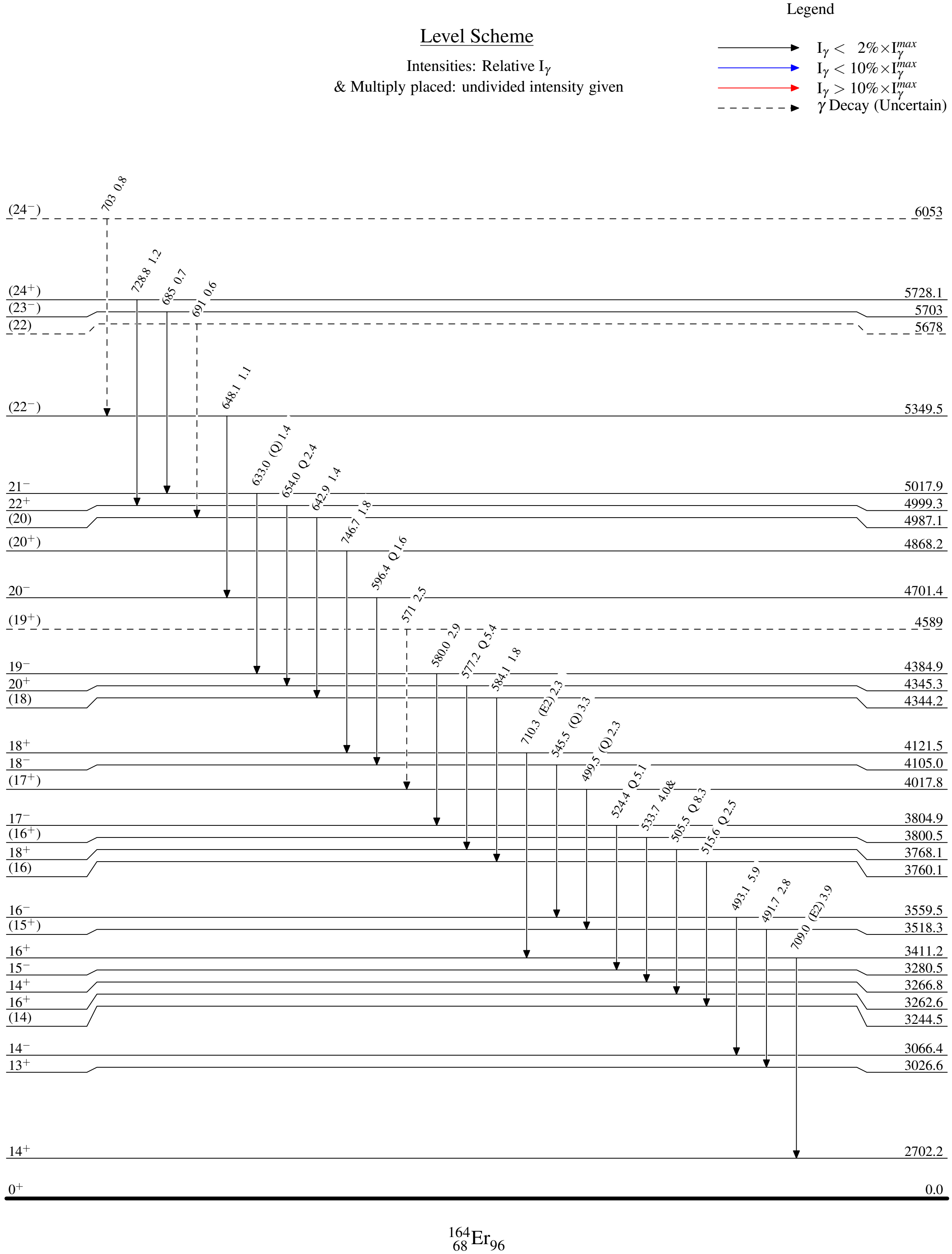
[&] Assigned by evaluators based on $\gamma(\theta)$ and polarization data in 1978Ki02. Mult=Q indicates ΔJ=2, quadrupole (most likely E2), mult=D indicates ΔJ=1, dipole, with possible quadrupole admixture when a transition does not involve parity change. For low-energy transitions (<400 keV or so), ΔJ=2, quadrupole transitions are assigned (E2), assuming the level half-life is <20 ns or so.

[a] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[b] Multiply placed with undivided intensity.

[c] Placement of transition in the level scheme is uncertain.

$^{160}Gd(^{9}Be,5n\gamma)$:E=59 MeV 1978Ki02

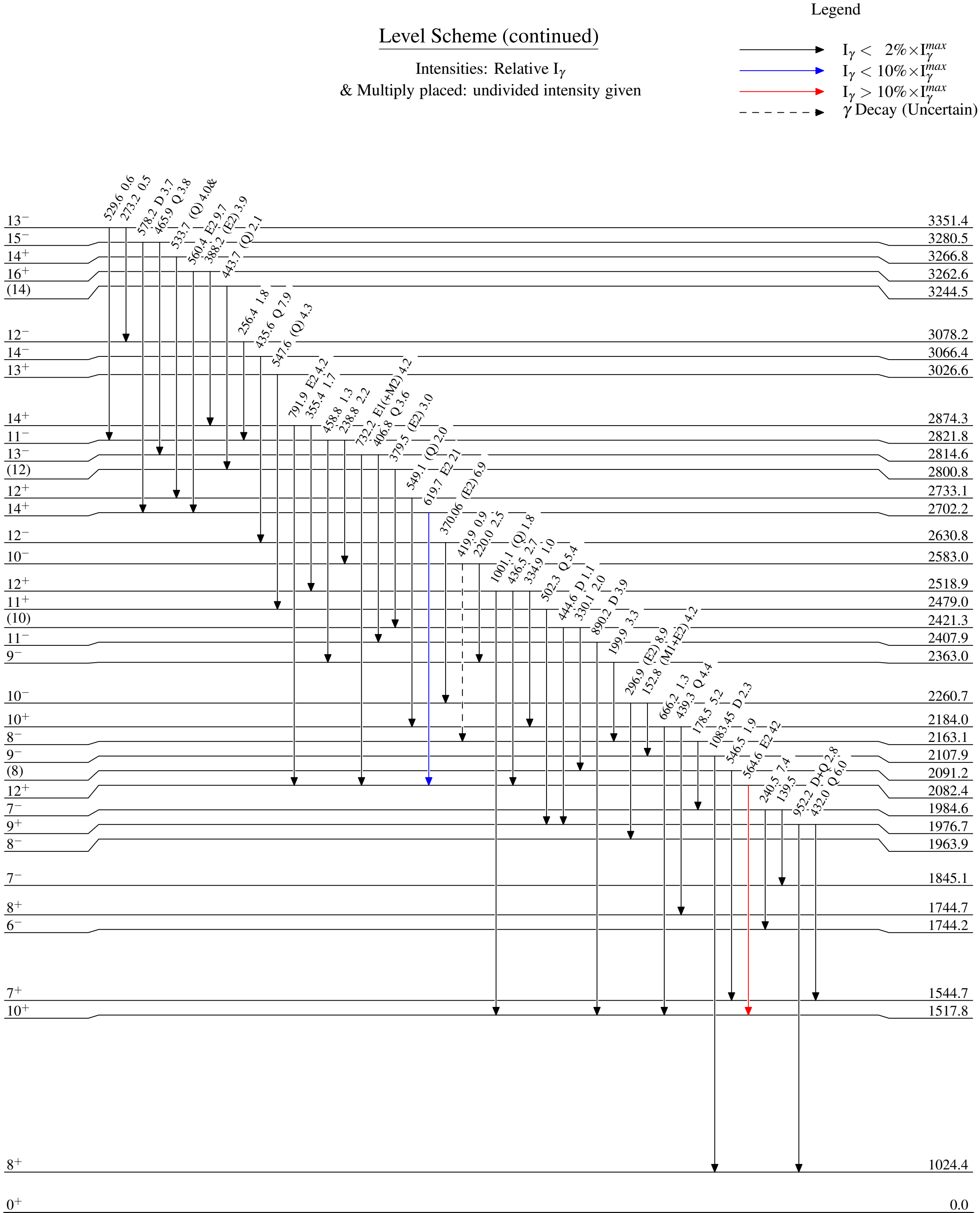


$^{160}Gd(^{9}Be,5n\gamma)$:E=59 MeV 1978Ki02

Level Scheme (continued)

Intensities: Relative I_γ

& Multiply placed: undivided intensity given

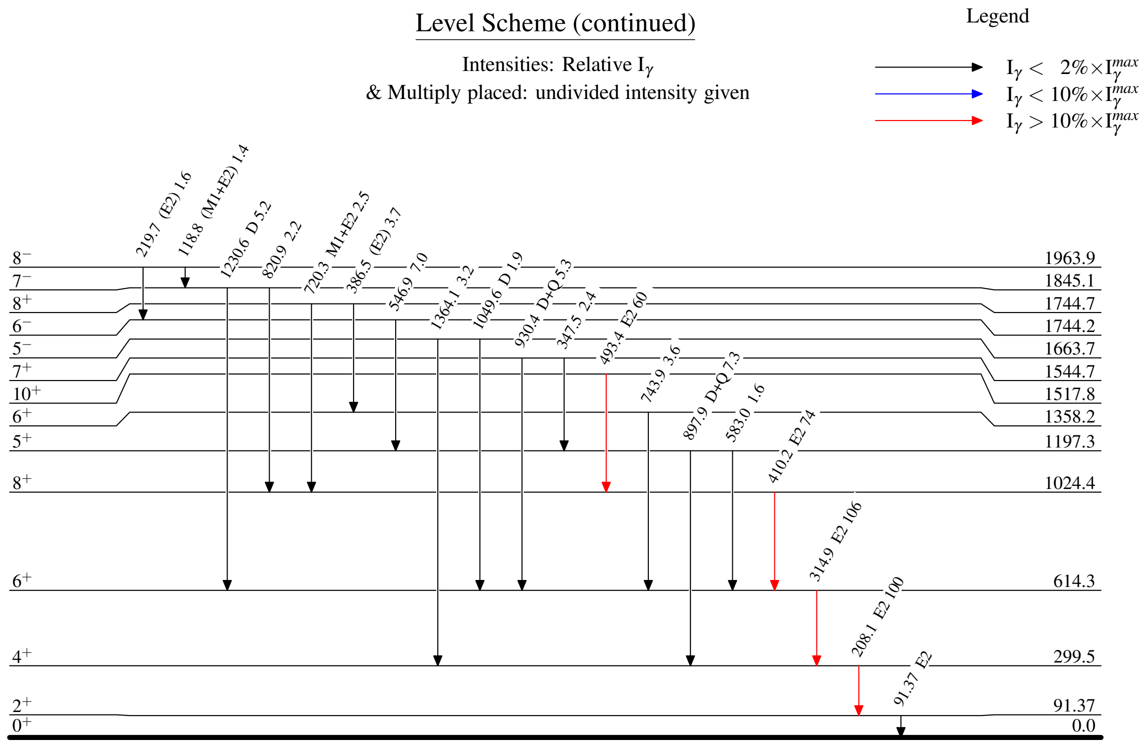


$^{164}_{68}Er_{96}$

^{160}Gd(^{9}Be,5nγ):E=59 MeV 1978Ki02

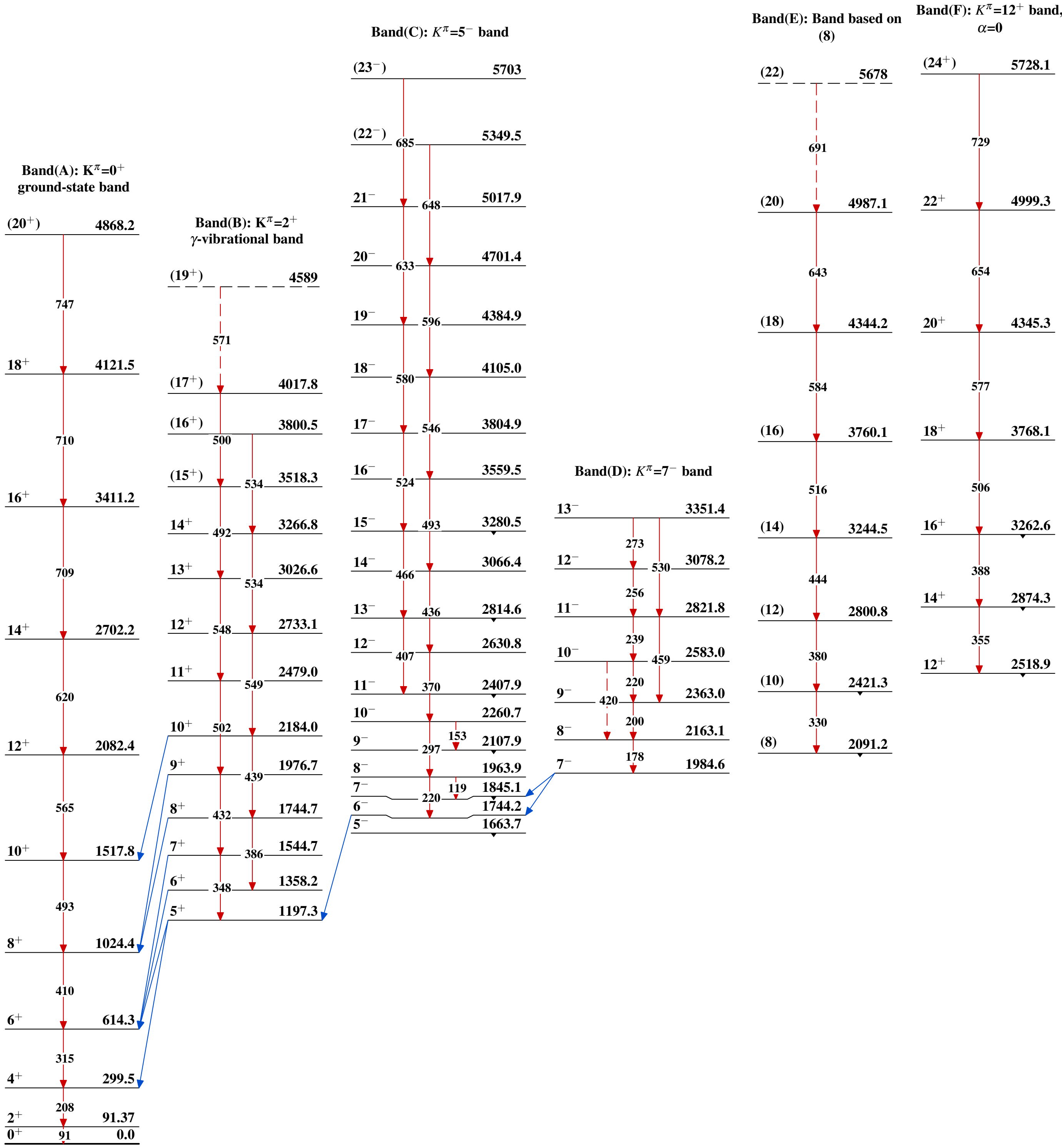
Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



$^{164}_{68}Er_{96}$

^{160}Gd(^{9}Be,5nγ):E=59 MeV 1978Ki02



$^{164}_{68}Er_{96}$